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RISTEKDIKTI

PERTAMINA EP
ASSET 3 TAMBUN FIELD

SEMINAR TAHUNAN HASIL PENELITIAN PERIKANAN DAN KELAUTAN VI
ANNUAL SEMINAR OF FISHERIES AND MARINE SCIENCE VI

PROSIDING

APLIKASI IPTEK PERIKANAN DAN KELAUTAN DALAM PENGELOLAAN, MITIGASI BENCANA DAN DEGRADASI WILAYAH PESISIR, LAUT DAN PULAU-PULAU KECIL

APPLICATION OF FISHERIES AND MARINE SCIENCE AND TECHNOLOGY ON MANAGEMENT, MITIGATION OF DISASTER AND ENVIRONMENTAL DEGRADATION IN COASTAL AREAS, SEAS AND SMALL ISLANDS

SEMARANG, 12 NOVEMBER 2016

FAKULTAS PERIKANAN DAN ILMU KELAUTAN
UNIVERSITAS DIPONEGORO
JUNI, 2017

KATA PENGANTAR

Tahun 2016 merupakan seminar tahunan ke VI yang diselenggarakan oleh FPIK UNDIP. Kegiatan seminar ini telah dimulai sejak tahun 2007 dan dilaksanakan secara berkala. Tema kegiatan seminar dari tahun ketahun bervariatif mengikuti perkembangan isu terkini di sektor perikanan dan kelautan.

Kegiatan seminar ini merupakan salah satu bentuk kontribusi perguruan tinggi khususnya FPIK UNDIP dalam upaya mendukung pembangunan di sektor perikanan dan kelautan. IPTEK sangat diperlukan untuk mendukung pembangunan sehingga tujuan pembangunan dapat tercapai dan bermanfaat bagi kemakmuran rakyat.

Dalam implementasi pembangunan selalu ada dampak yang ditimbulkan. Untuk itu, diperlukan suatu upaya agar dampak negatif dapat diminimalisir atau bahkan tidak terjadi. Oleh karena itu, Seminar ini bertemakan tentang **Aplikasi IPTEK Perikanan dan Kelautan dalam Mitigasi Bencana dan Degradasi Wilayah Pesisir, Laut dan Pulau-Pulau Kecil.** Pada kesempatan kali ini, diharapkan IPTEK hasil penelitian mengenai pengelolaan, mitigasi bencana dan degradasi wilayah pesisir, laut dan pulau-pulau kecil dapat terpublikasikan sehingga dapat dimanfaatkan untuk pembangunan yang berkelanjutan dan dapat menjaga kelestarian lingkungan. Seminar Tahunan Hasil Penelitian Perikanan dan Kelautan ke-VI merupakan kolaborasi FPIK UNDIP dan Pusat Kajian Mitigasi Bencana dan Rehabilitasi Pesisir (PKMBRP) UNDIP.

Pada kesempatan ini kami selaku panitia penyelenggara mengucapkan terimakasih kepada pemakalah, reviewer, peserta serta Pertamina EP Asset 3 Tambun Field yang telah mendukung kegiatan Seminar Tahunan Penelitian Hasil Penelitian Perikanan dan Kelautan VI sehingga dapat terlaksana dengan baik. Harapan kami semoga hasil seminar ini dapat memberikan kontribusi dalam upaya mitigasi bencana dan rehabilitasi pesisir, laut dan pulau-pulau kecil.

Semarang, Juni 2017

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Diterbitkan oleh : Fakultas Perikanan dan Ilmu Kelautan, Universitas Diponegoro bekerjasama dengan Pusat Kajian Mitigasi Bencana dan Rehabilitasi Pesisir serta Pertamina EP Asset 3 Tambun Field

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Aplikasi IPTEK Perikanan dan Kelautan dalam Pengelolaan dan Pemanfaatan Sumberdaya Wilayah Pesisir, Laut dan Pulau-pulau Kecil (Pemanfaatan Sumberdaya Perairan)

PUSAT UNGGULAN IPTEK PERGURUAN TINGGI INDONESIA
RISTEKDIKTI
KEMENTERIAN KELAUTAN DAN PERIKANAN
PERTAMINA EP
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EFFECT OF DIFFERENT SOAKING TIME IN COCONUT SHELL LIQUID SMOKE TO THE PROFILE OF LIPIDS CAT FISH (*CLARIAS BATRACHUS*) SMOKE

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ABSTRACT

Catfish is a freshwater fish that contain fat quite high due to the feed. Catfish fat can affect oxidation, end product quality smoked of fish. The addition of liquid smoke in the smoking process was able to maintain the fatty acids, especially unsaturated fatty acids. The compounds in the liquid smoke serves to inhibit and prevent the oxidation of fat. Phenol content in liquid smoke works by stabilizing free radicals, thus preventing damage to fat. The material used in this study are catfish, coconut shell liquid smoke, salt, and water. The experimental design used is Complete Random Design (RAL), which consists of one treatment (long immersion in liquid smoke) 0 hours, 1 hour, 2 hours, and 3 hours with repeat 3 times. Parameter testing include test fat levels, fatty acids profile, cholesterol, phenol content, water content, and hedonic. The results showed that long immersion in different liquid smoke significant effect on levels of fat, cholesterol, phenol levels, and fatty acids profile. The value of the fat content of each treatment 0 hour, 1 hour, 2 hours, and 3 hours were 5.39 ± 0.11%; 6.76 ± 0.08%; 9.32 ± 0.37%; 11.43 ± 0.11%. Values saturated fatty acid profile of 29.27%, 37.61%, 38, 90%, and 39.20%. Unsaturated fatty acids of 38.16%, 42.53%, 52.10%, and 54.13%. Cholesterol values of 13,5±0,26mg/100; 10,35±0,13mg/100; 8,12±0,10mg/100; 5,15±0,93mg/100. Water content of 62.09 ± 0.90%; 56.44 ± 2.28%; 52.40 ± 0.57%; 51.99 ± 1.08%. Value phenol content of 2,18±0,05mg/l; 3,39±0,14mg/l; 5,33±0,37mg/l; 6,47±0,32mg/l. Fish treatment is most effective for maintaining the quality of fatty acids in general are soaking time 2 hours

Keywords: Catfish, Coconut Shell Liquid Smoke, Fatty Acid Profile

I. INTRODUCTION

Fishing is an important sector in foreign exchange earnings to the development of Indonesia. Fish has an important role in the improvement of human nutrition. The production of aquaculture in 2009 reached 4.71 million tons. Lele fish farming in Central Java is increasing every year, so that the processed product and catfish fish consumption is also higher. In 2010, production Catfish in Central Java province from aquaculture pond reaches 36394.5 tons. Demak is one of the most highly rated producers farming catfish fish production amounted to 12,550 tons (Directorate General of Aquaculture, 2013).

Catfish is one of fishery products that contain fatty acids that are quite high. Fatty acids are long-chain organic acids having a carboxyl group (COOH) at one end and a methyl group (CH3) at the other end. Processed fish catfish very loved by the people because the price of fish catfish is quite affordable and has a savory taste, so it has been used optimally into smoked fish and processed food diversification. According Murniyati *et a*l. (2013), catfish fat can lower LDL (Low Density Lipids) cholesterol in the blood

plasma. Fish fatty acids generally straight carbon chain and have carbon atoms between 14-24 atoms.

The fish is needed by the human body because it has some benefits, among others educate the brain, helps the growth period, and lower triglyceride levels. One of the processed fish to maintain the content of fatty acids is a smoked fish. Curing fish with liquid smoke can inhibit the oxidation of fat because it contains phenols, organic acids, and antioxidants, so that evaporation can maintain-acid content of unsaturated fatty acids required for the body. According Darmadji (1999), liquid smoke coconut shell proven to have a major distinction in terms of the intensity of the color, smell, and taste-specific and was followed by the ability to inhibit the growth of mold and fat oxidation.

II. MATERIALS AND METHODS

2.1. Smoking process

The fish were dipped in the 5 % brine solution, and then dipped in the 1 % liquid smoke solution. Liquid smoke was produced from coconut shell. The dipping process were divided into three groups different soaking time: (i) the fish dipped in liquid smoke without soaking shell as control; (ii) the fish dipped in liquid smoke soaking time in one hours (1h); (iii) the the fish dipped in liquid smoke soaking time in two hours (2h); and (iv) the the fish dipped in liquid smoke soaking time three hours (3h). The processing time and temperature in the kiln were at 90 ºC (3 h). After heating and cooling process, the fatty acid and quality (lipid; water; phenol and hedonic content) of smoked fish were observed.

2.2. Fatty acid composition

Approximately 25 mg of fat, obtained from the lipid extraction according to Folch *et al*. (1957), were saponified, and the fatty acids converted to methyl esters according to Joseph and Ackman (1992). The methyl esters were dissolved in hexane and 2 mL were injected into a gas chromatograph with a flame ionization detector (GC-FID) (Shimadzu, model GC 2010, Kyoto, Japan). The methyl esters were separated in a capillary column of melted silica (100 m _ 0.25 mm i.d., 0.20 mm thickness of the stationary phase) (CP-SIL 88, Chromopack, Middleburg, The Netherlands) and identified by comparison of the retention times of the sample peaks with those of standards (FAME Mix C4eC24, Supelco, Bellefonte, Pennsylvania, USA). The quantification was carried out by internal standardization using the tridecanoic acid methyl ester as internal standard added before sample injection. The results were calculated in mg per 100 g of sample (AOCS, 1989).

2.3. Chemical composition

2.3.1. Total Lipid Content

Total Lipid Content was determined by Soxhlet extraction method using petroleum ether solvent (Soxhlet, 1879) and by Bligh and Dyer method using methanol-chloroform (2:1, v/v) (Bligh & Dyer, 1959).

2.3.2. Cholesterol

Cholesterol content was estimated using Liebermann-Burchard reagent (Attarde *et al*., 2010). Standard cholesterol solution used was 2 mg/ml as stock solution. Liebermann-Burchard reagent was prepared with 7 ml concentrated sulfuric acid and 5 ml glacial acetic acid and was covered with black paper and kept in ice bucket in dark place.

2.3.3. Water content

Determination of water smoked fish were carried out in triplicate according to AOAC 2005. Water content of the samples were determined by method in which 2 g of the samples (fish muscles) were oven-dried at 110±1°C for 3 h to a constant weight. Loss in weight is equal to the water content of the original sample.

2.3.4. Total phenol

The total phenolic content were determined by using the Folin Ciocalteu assay. A reagent blank using distilled water was prepared. 1 ml of Folin-Ciocalteu phenol reagent was added to the mixture and shaken. After 5 minutes 10 ml of 7% Na2CO3 solution was added to the mixture. The volume was then made up to the mark. After incubation for 90 minutes at room temperature, the absorbance against the reagent blank was determined at 765 nm with an UV-Visible spectrophotometer.

2.4. Hedonic test

The organoleptic evaluation of the smoked samples was carried out using a 30 member panelists. Parameters such as flavour, texture, odour, appearance and general taste were used to compare the organoleptic characteristics of the products. Questionnaires were used by the panelists and scoring was done on a weekly basis. The questionnaires were prepared using a 5 point hedonic scale as suggested by Poste *et al*. (1991). The points are as outlined below: Very good – 5, Good – 4, Averagely good – 3, Fair – 2, and Bad – 1

2.5 StatisticalAnalysis

Experimental fishes were laid out in a completely randomized design. The data obtained were subjected to analysis of variance (ANOVA) and using statistical package for social science (SPSS) Version 16.0 computer software.

III. RESULT

The preliminary study was conducted to determine the best concentration of Catfish smoked with concentration (1%); (3%); and (5%) by carrying out organoleptic tests include appearance, odor, flavor, texture, fungi, slime and concluded that the highest value and the best of the three treatments is the concentration of 1% to be used for primary research. The main research uses a 1% concentration with a long treatment difference immersion in liquid smoke that is control, 1 hour, 2 hours, and 3 hours in cold temperatures.

3.1. Fatty Acid Analysis

The results indicate that the fatty acid profile obtained has two types of fatty acids. Class of fatty acids are found consisting of saturated fatty acids and unsaturated fatty acids. Difference between the two lies in their chemical bonds, where the saturated fatty acid has no double bonds. These differences led to their physical and chemical properties of both these fatty acids. Based on the results of Table 1 shows the saturated fatty acids of fish catfish on difference in the treatment of soaking liquid smoke for control, 1 hour, 2 hours, and 3 hours on average by 29.27%, 37.61%, 38, 90%, and 39 , 20%, while unsaturated fatty acids are as follows: control, 1 hour, 2 hours, and 3 hours on average by 38.16%, 42.53%, 52.10% and 54.13%. Differences in the composition of fatty acids in each sample was highly dependent on the source of these fats. According Pujiati *et al*. (2005), the composition of fatty acids remain in the fish that have been preserved using liquid smoke. The smoked fish was still able to meet essential fatty acid needs. Palmitoleic acid, 11-oktadekenoat acid, and oleic acid is an unsaturated fatty acid. Palmitic acid, isostearic acid and stearic acid is a saturated fatty acid. Arachidonic acid (ARA) and Eikosapetaenoat acid (EPA) is an omega-3 fatty acids, essential fatty acids whose role is very important for the body, among others, are useful in the development of the brain and nervous sense of sight.

Tabel 1. Fatty Acid Catfish Smoke

Fatty Acid	Fatty acid content (%) in the immersion liquid smoke			
	control	1 hour	2 hours	3 hours
1.Saturated Fatty Acids				
Myristic acid (C14:0)	1,51	1,25	2,18	1,65
Palmitate acid (C16:0)	18,75	24,86	28,16	29,22
Stearat acid (C18:0)	6,95	7,87	7,78	6,56
Laurat acid (C12:0)	2,06	3,63	0,78	1,77
Jumlah	29,27	37,61	38,90	39,20
2. Unsaturated Fatty Acids				

- Mono Unsaturated Fatty Acids				
Elaidic acid (C18:1n-9)	22,30	24,77	26,12	32,27
Palmitoleic acid (C16:1n-7)	2,06	1,45	3,19	1,36
Oleat acid (C18:1n-9)	0,78	3,09	3,83	5,42
-Poly Unsaturated Fatty Acids				
*Linoleat acid (C18:2n-6)	10,59	11,18	11,98	11,47
*arachidonic acid (C20:4n-6)	1,66	0,67	2,84	0,64
*EPA (C20:5n-3)	0,77	1,37	4,14	2,97
Jumlah	38,16	42,53	52,10	54,13

Description: * sign an essential fatty acid

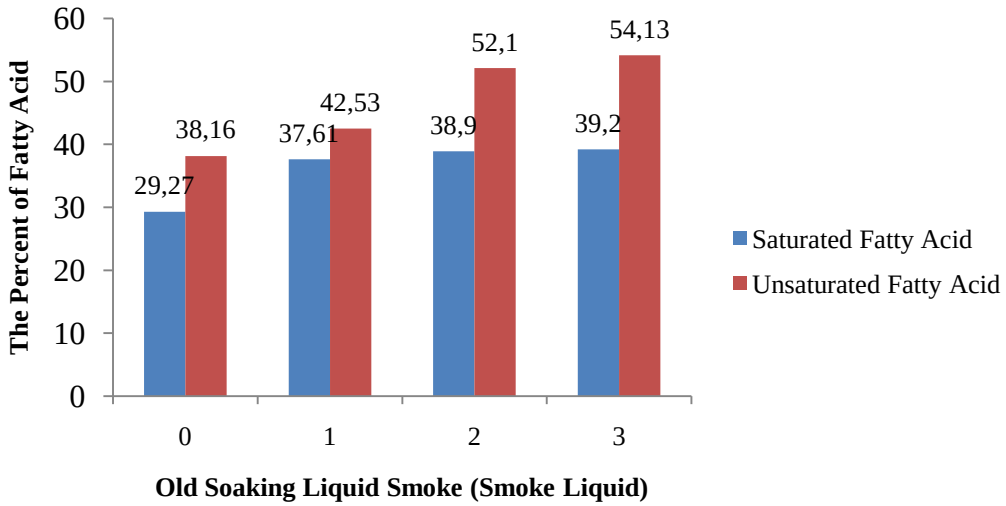

Figure 1. Fatty Acid Profile

1. Saturated Fatty Acid

The content of saturated fatty acids in each treatment shows the results of different it is because these fatty acids are the basic components of the formation of fat in fish catfish, while the content of unsaturated fatty acids in fish are high can be caused due to the mechanism of the food chain and the activity of the fish high, causing large enough fat reserves. According Afrianto and Liviawaty (2005), need fat in fish is influenced by environmental conditions, feed and seasonal variations. Differences fatty acids in marine and freshwater fish related to the specific needs of these fish to adapt physiologically to the environment. Feed also affect the composition of fatty acids in fish.

Results showed that saturated fatty acid palmitic acid has a percentage value compared with other saturated fatty acids. Palmitic fatty acid is a long chain saturated fatty acids contained in animal fats. Foods that contain lots of saturated fat is not good for health. According Jacoeb *et al*. (2014), shows the palmitic acid is a saturated fatty acid (SFA) with

the highest levels, both in the flesh of fresh eel and eel stew. Fresh eel contains palmitate 13.79% and subject to change after the boiling process becomes 12.88%. Palmitic acid is a saturated fatty acid (SFA) is most commonly found in foodstuffs, ie (15-50)% of total fatty acids that exist (Winarno 2008).

2. Unsaturated Fatty Acid

Unsaturated fatty acids are fatty acids that have the double bond in their chemical structure. Unsaturated fatty acids are divided into two types, namely monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA). MUFA is an unsaturated fatty acid having only one double bond, whereas PUFAs are fatty acids that have more than one double bond. PUFAs made up of fatty acids omega-3 (n-3), omega-6 (n-6), and omega-9 (N-9), a growing number of double bonds in unsaturated fat, the more vulnerable nature against fat oxidation, in addition to the unsaturated fatty acids will also be damaged if exposed to heat. By Arpi (2014), oxidation easily occur in the processing, storage, and use of oil in food fats, oxidation will cause rancidity. Prevention of oxidation of fatty food can be done with good handling and storage, among others at the appropriate temperature, not exposed to light, low water content, and the absence of a metal catalyst. Oxidation can also be prevented by the addition of antioxidants, which is a compound in a small amount can slow oxidation in the material. Certain food ingredients contain antioxidants naturally, but natural antioxidant content generally decreased during the treatment process.Eicosapentaenoic acid (EPA) adalah dua rantai panjang asam lemak tak jenuh ganda milik Omega-3.

EPA content is determined by the type of fatty fish used. Table 1 shows that the EPA in the treatment of soaking liquid smoke on the control to 3 hours soaking time is getting higher. Control by 0.77%, 1 hour by 1.37%, 2.84% at 2 hours and 3 hours by 2.97%, but the soaking time 2 hours to 3 hours with smoked catfish fish began to decline. This is because the longer the oxidation of fish catfish decomposed due to the fat composition is different. Unsaturated fatty acids lead to fats in fish is easily oxidized. The oxidation process can cause the flavor and taste are not preferred as well as a decrease in nutritional value. This is consistent with research Purwaningsih *et al*. (2014), the effect of fish processing affect the content of unsaturated fatty acids such as fish Glodohk, EPA fresh fish 11.14%, 12.46% salt boiled, cooked without treatment 12.08%, 13.50% and steamed. According Kolalowska (2003), fat oxidation stability is influenced by internal and external factors, such as fatty acid composition, content of prooxidant, antioxidant,

irradiation, temperature, oxygen, the surface area in contact with oxygen, the level of processing and storage conditions.

3.2. Chemical Composition Analysis

Table 2. Test Results fish Catfish Smoke

Test	Treatment			
	control	1 hour	2 hours	3 hours
Total Lipid Content (%)	5,39±0,11a	6,76±0,08b	9,32±0,37c	11,43±0,11d
Cholesterol (mg/10g)	13,5±0,26a	10,35±0,13b	8,12±0,10c	5,15±0,93d
Water content (%)	62,09±0,90a	56,44±2,28b	52,40±0,57c	51.99±1,08c
Total phenol (mg/l)	2,18±0,05a	3,39±0,14b	5,33±0,37c	6,47±0,32d

Information:
- Data is the average of three replicates ± standard deviation
- Data followed different letters indicate significant differences (≤ 0.05)

Analysis of Fat Content

The content of the highest fat content contained in the long immersion liquid smoke 3 hours 11.43% and the lowest is the long soaking liquid smoke for 0 hours. The influence of the value of the fat content in fish smoked catfish in each treatment due to their phenolic compounds seep into the structure of the fish meat catfish. Aktifivitas phenol having antioxidant that can prevent the oxidation reaction. The oxidation reaction is influenced by phenol antioxidant compounds that provide hydrogen groups in preventing fat oxidation and damage. Small big influence results of the fat content is determined by the water content contained in the fish, the evaporation process can generally reduce the water content of the composition as a result of the heat treatment process. The heat that comes from the fuel will penetrate into the network structure of fish meat, then the water will come out. According Yusnaini *et al*. (2015), the water content in the process of curing fish smaller than that of the fresh material due to the method of heating and the final temperature that is used.

Analysis of Cholesterol Levels

Cholesterol levels were obtained by long immersion liquid smoke for 1 hour, 2 hours, and 3 hours respectively is 10.35 mg / 100g, 8.12 mg / 100g, and 5.15 mg / 100g. Lele fish cholesterol content analysis was conducted to determine the treatment prolonged submersion different liquid smoke can lower cholesterol levels in fish catfish. Based on the results of Table 10 decrease in cholesterol levels were highest occurred in the commission of 3 hours soaking time is equal to 5.15 mg / 100g, while the percentage decrease in

cholesterol levels was lowest in controls (0 hour soaking time), so it was concluded that the cholesterol content than control experience real difference. Decrease in cholesterol levels caused by the content of phenol-containing antioxidant. This antioxidant substances could inhibit oxidation reactions by binding free radicals and reactive molecules. According Swastawati (2009), a decrease in cholesterol content can be due administration of liquid smoke in the smoking process, because the phenolic compounds contained in the liquid smoke can break the chains of fat oxidation in the initiation phase. Phenolic compounds contained in liquid smoke are antioxidants and antibacterial.

Results Analysis of Water Content

The results of water content in fish catfish showed that the water content control (0 hours) has exceeded the limits of the standard Indonesian National Standard (2013) is a maximum of 60%. Results of treatment of soaking liquid smoke at 0% has a value of 62.09%, while the treatment of 1 hour, 2 hours and 3 hours is 56.44%, 52.40% and 51.99%. This is in comparison research Syarafina *et al*. (2014), Tengiri smoked fish with a value of liquid smoke soaking time of 5 minutes 50.85%, 48.72% 10 minutes, and 15 minutes 47.62%. According Swastawati (2011), stated that the decrease in water levels also dipengaruh by their treatment prior to curing such as draining and soaking in the concentration of certain salts

Results Analysis of Phenol Content

The results of the analysis show that the phenol content of phenol levels with long soaking liquid smoke different on catfish smoke rose. This is due to the longer time soaking smoked catfish fish the more phenol compounds are absorbed into the catfish. Phenol compounds are in liquid smoke coconut tempuung are antioxidants that inhibit the oxidation of fatty fish catfish processed fish products cause damage. Phenol was instrumental in forming the taste and aroma of fisheries products. According Soazo *et al*. (2015), a liquid smoke product comprising phenol, carbonyl component and acetic acid. Phenol functions as an antioxidant and antibacterial food. Lira *et al*. (2013), stating the amount of salt, hot distance, time of fumigation will affect the curing phenol but no effect on the increase in cholesterol, the cholesterol is determined by polyunsaturated fatty acids only found on shrimp.

The results showed that the effectiveness of phenol greatest lies in the long immersion liquid smoke 2 hours. Value effectiveness of phenol can be seen on the biggest difference on a long hose soaking liquid smoke that has a difference of 1,94. Based on the results table is known that phenol levels in 3 hours soaking time of 6,47mg/l is the largest

phenol content. According Swastawati et al. (2009), vinegar has a high phenol content does not always produce smoked fish with high levels of phenols. Instead of smoke that have a low phenol content can be absorbed more into the flesh of fish depend on the nature and texture of the flesh of fish biology, in the application of fumigation concentration used is 1-3%, which is sufficient for consumers.

3.3. Hedonic Test

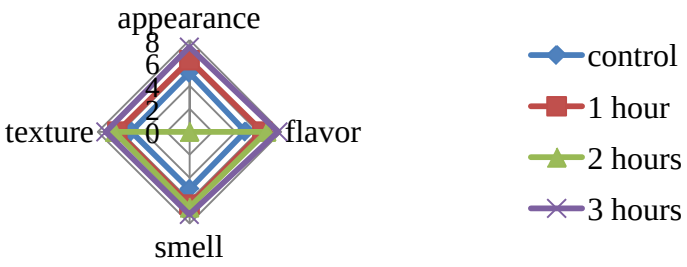

Figure 2. Diagram Hedonic Test

Table 3. Data Value Hedonic Test Catfish Smoke Based Differences in Old Soaking Liquid Smoke

Specification	Soaking Liquid Smoke			
	Control	1 hour	2 hours	3 hours
Appearance	5,90±0,75a	6,86±0,62b	7,26±0,63c	8,10±0,71d
Flavor	5,73±0,83a	6,96±0,61b	7,46±0,73bc	8,06±0,69d
Smell	5,63±0,61a	7,03±0,67b	7,30±0,70bc	7,97±0,76d
Texture	5,86±0,77a	6,90±0,61b	7,20±0,66bc	7,93±0,63d
Average	5,78±0,74	6,93±0,62	7,31±0,68	8,02±0,70

Based on the hedonic test results against control smoked catfish fish at test level obtained 95% confidence interval of $5.648 \leq \mu \leq 5.918$, so it can be concluded that fish smoked catfish are less preferred by the panelists. Soaking time 1 hour on the obtained confidence interval of $6.851 \leq \mu \leq 7.033$, the soaking time 2 hours gained the confidence interval of $7.170 \leq \mu \leq 7.446$, and the soaking time 3 hours gained the confidence interval of $7.862 \leq \mu \leq 8.172$, so it concluded that the treatment 3 hours soaking time provide results that most preferred by the panelists.

The resulting texture in smoked catfish fish that is dense, compact, fairly elastic, and not loud. This texture is affected due to long curing time is causing water levels of smoke is reduced, causing a mushy texture. Cai long immersion in the smoke will affect the amount of phenol produced, the longer the curing time will cause phenol components that attach to the fish will be many more. According Adiyastiti *et al*. (2014), the physical properties of the meat, such as color, texture, hardness and tenderness of meat is affected by the binding power of water, the water content of the matrix protein's ability to hold

water or absorb water being added from outside influences such as cooking. Violence is the deciding factor in the formation of the texture of a product.

Conclusion

Giving long difference in liquid smoke tehadap Catfish (*Clarias batrachus*) Smoke significant effect on the decline in fish fat profile catfish. The use of liquid smoke time difference is 1 hour, 2 hours, and 3 hours tend to lower cholesterol levels and water content, maintaining the levels of fat, as well as maintaining the unsaturated fatty acids and EPA on smoked catfish.

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